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AUTHOR	Cooper, William
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ABSTRACT

The material presented here is the result of a review of the Technical Development Plan of the National Library of Medicine, made with the object of describing the role of audiovisual materials in medical education, research and service, and particularly in the continuing education of physicians and allied health personnel. A historical background of the use of audiovisual materials in medical and health professional education is given. The benefits and problems of resource sharing with other institutional producers of audiovisual materials are identified, and the primary users and uses of audiovisual material in health science education, the facilities, equipment, and capabilities required for extended use of these materials are described. The potential role of the Biomedical Communications Network is discussed and a description of a typical learning resource center in a medical school is provided. (JY)

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RESEARCH MEMORANDUM

Biomedical Communications Project

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ROLE OF AUDIO AND AUDIO-VISUAL MATERIALS IN ENHANCING THE LEARNING PROCESS OF HEALTH SCIENCE PERSONNEL

RM-969

January 1969

William Cooper

Prepared for the
National Library of Medicine
Bethesda, Maryland

Under contract with the
University of Pittsburgh
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ROLE OF AUDIO AND AUDIO-VISUAL MATERIALS IN ENHANCING THE LEARNING PROCESS OF HEALTH SCIENCE PERSONNEL

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January 1969

William Cooper

Director

Office of Educational Resources

University of Colorado Medical Center

Denver, Colorado

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The purpose of this Research Memorandum is to review the Technical Development Plan (TDP) of the National Library of Medicine, particularly the Audio and Audio-Visual Component, with the object of describing the role of Audio and Audio-Visual Materials in medical education, research and service, and particularly in the continuing education of physicians and allied health personnel.

Historical Background on the Use of Audio and Audio-Visual Materials in Medical and Allied Health Professional Education

Audio and Audio-Visual materials have been traditionally associated in the past with elementary and secondary school instruction. The range of applications of these materials was quite limited by virtue of the materials that were produced as well as by the very restricted availability of the playback equipment. The variety, simplicity, and availability of production and playback equipment in recent years partly accounts for the steady rise of audio-visual utilization in undergraduate educational institutions and, finally, in graduate and postgraduate educational programs.

Although audio-visual materials were once limited to phonograph records and photographic slides, they now include a wide variety of formats.

1. Audio

    a. Records
    b. Reel-to-reel tapes
    c. Tape cartridges

2. Film

a. Cut Film

1. Cut film of black and white or color varying in size from 35mm, 2x2 2" mounted slides, 3¼ x 4 lantern slides, etc.

b. Strip Film

1. 35mm with cartridge, 35mm without cartridge

c. Motion Picture Film

1. 8mm with or without sound track
2. 16mm with or without sound track
3. 35mm with or without sound track

d. Loop Films

1. 8mm with or without audio track
2. 16mm with or without audio track
3. 8 or 16mm with separate audio in snapout cartridge format

e. Kinescopes of television production in any of above formats, c or d.

3. Video Tape

A wide variety of units are available with tape widths ranging from one-quarter inch to two inches in width with the quality of reproduction increasing with the width of the tape. The tapes are played at varying speeds depending upon the equipment used. There is a very serious dilemma regarding the compatibility for playback between video tape recorders from various manufacturers.

Of all the fields of biomedicine, biologists have been one of the most prominent users of audio-visual materials in order to augment the learning of students of the dynamic and pictorial processes which are inherent in the study of biology. These

materials have also been used in the past to augment the instruction in hopes of reducing the heavy teaching loads that have been increasing as the number of undergraduate students in biology have been increasing. One case in point is the innovative use of these materials by Dr. S.N. Postlethwait of Purdue University who was one of the first to design self-tutorial laboratories for his students in biology.

In fields directly related to patient care, audio-visual materials have appeared most frequently and been used with greatest enthusiasm by those involved in instruction in nursing arts.

In recent years, medical schools have become aware of the problems and the benefits of the use of audio-visual materials in their training programs. Despite the problems related to cost and quality of the materials produced, it has been apparent that many schools are becoming increasingly aware of the benefits that result from the use of these materials, namely, augmented and enhanced learning by their students. Some medical schools have appointed members of their faculties to act as audio-visual coordinators. The coordinator's job has been primarily one of centralizing the review of proposed equipment purchases. In this regard, 42 medical schools have appointed such coordinators to assist them in this difficult problem. Most recently, Learning Resource Departments or Educational Resource Offices have been appearing in medical schools. The University of Colorado's Office of Educational Resources is typical of these new organizational units which serve

the medical center at large regarding the production, availability and utilization of audio-visual materials. Other examples of Learning Resource Departments are located at the University of California at San Diego and the University of Arizona.

The functions of the Learning Resources Department are broader than those of audio-visual coordinators. Where the audio-visual coordinator is primarily responsible for the coordination of purchasing AV equipment, the Learning Resources Departments are now deeply involved in curriculum and in the study of the effectiveness of the teaching-learning process. The responsibilities of the Learning Resources Department are limited only by the authority vested in them by the institution and the imagination of the Learning Resources staff. Typically, the Learning Resources Departments are responsible for any and all forms of audio or visual instruction, including but not limited to graphics, photography, films and television production, including video tape.

Since one of the applications of audio-visual materials is in the area of continuing medical education, the growth of these media is often tied to the continuing education activities of institutions. Audio-visual materials are used occasionally in traditional courses in continuing education, but seldom in short-term school or community resident programs, and very often in remote instruction. Fifty-eight medical schools have appointed directors of continuing education. It is estimated that 75 per cent of these appointees have initiated programs extensively employing audio-visual materials.

General Use of Audio-Visual Materials by Teachers and Students

In the past the most widespread use of audio and audio-visual materials has been in teacher-oriented programs, in which the teacher either projects the visuals or plays the audio from a central position at her desk and the students then look or listen to the program presented. In this setting, although primarily directed toward facilitating the teaching effort, there was all too little concern about the effect of these materials on the learning of the individual student. More recently, however, the emphasis has turned to the exploration of ways and means by which one can enhance the learning on the part of the student by the use of self-operating, readily available audio-visual materials. The manufacturers of educational hardware have developed a wide variety of devices in which individual students can retrieve audio and audio-visual information at their own convenience when their own motivation for learning is at a high level. The inherent problems related to this more individualized use of media are those involving the packaging of the programs; i.e.,"software". A wide variety of cartridges and cassettes containing not only audio tapes but loop motion picture films, and in some instances, video tapes are currently in production and use by a number of institutions throughout the country.

In addition to the use of these devices for individual retrieval of a standard bit of information, many other potential uses of these devices exist. In the area of student-teacher interaction and teacher evaluation as well as student evaluation, the use of audio tapes of student-student and student-teacher interactions are increasing in use in various educational institutions. Such applications lend themselves quite nicely to the development of appreciation of individual conflict as well as development of performances of certain skills and as an assist in the techniques of role-playing as used in attempting to effect attitudinal changes among students of the health science professions. It is in this area of individualized learning of information, skills and attitudinal changes that the future use of audio and audio-visual materials has the most exciting potential.

Use of Audio-Visual Materials in the Teaching of Subjects That Cannot Be Taught By Other Means

It goes without saying that in certain areas of education the use of audio-visual materials is essential to the dissemination of the information and the skill or technique which is being taught the student. When such materials are necessary for the teaching-learning process, then it is apparent that the teacher could be replaced for these settings by a well-trained projectionist, adequately functioning equipment, and well-prepared self-explanatory materials, e.g., audio-visual software materials. When such areas of curricula can be identified in advance, it is obvious that a

great savings of time and talent of the teacher can be effected. Some examples of these settings include movies or sequence slides of operative procedures or generalized drilling in language laboratories, audio recordings of written word passages, and audio tapes of lectures in which no visual materials were presented and no blackboard used.

Benefits and Problems of Resource Sharing With Other Institutional Producers of Audio and Audio-Visual Materials

The greatest majority of the audio and audio-visual materials that are produced in the institutions in this country are retained by each institution for exclusive use on its own campus. It is obvious that this state of affairs leads to an extensive amount of duplication of time and effort on the parts of each of the individual learning institutions. Probably the main reason for repeating the production of producing institutions is that the quality of production that exists is not adequate for their own individual use. Still another reason is that the existing production is not so relevant as one that they could indeed produce themselves. As a result of this conflict, another production is made. One mechanism that might avoid such a trend is the ability to separate the audio portion from the visual portion of any future production. By so doing, one could change the audio tape at a given institution to augment the visual portion which could be available on an exchange basis with large numbers of instituions having access to them. If this were done, the costly portion of the production,

namely the visual portion, would be saved and the audio portion, which contains the teacher's own voice, could bring to the production the degree of relevance that is required for the individual learning situation. In addition to the many medical schools and nursing schools that have repositories of audio-visual materials, some of the organizations with major repositories include: National Medical Audio-Visual Center, Indiana University, The University of Wisconsin, Audio Digest, the Royal College of General Practitioners of Great Britain, Purdue University, Professional Research Inc., Albany Medical College, the University of Utah, the University of Washington, Ohio State University, The University of North Carolina, and the National Center for Audio Tapes at the University of Colorado in Boulder, among others.

The utilization of audio-visual materials is very much dependent upon the ability of the user to be aware of their availability and have access to them. It is, therefore, quite apparent that one of the major problems involving utilization of audio and audio-visual materials in health science education is the extreme difficulty in being able to obtain information regarding the existence of a given program and some knowledge of its content. Some catalogs of audio-visual materials have been prepared by the National Medical Audio-Visual Center and the American Medical Association. The NMAC catalog is a compilation of films which includes a written description of the film and a notation on the availability of film reviews.

Indexing of audio-visual materials is a major concern of various committees and agencies. It is agreed that no one has a clear idea where these materials are, what these materials consist of and how they can best be indexed. The National Committee for the Distribution of Audio-Visual Materials recently appointed an ad hoc committee to identify the problems of indexing 8mm film cassettes. It was felt that the problems of indexing all audio-visual materials was so vast that the committee should restrict itself to one material form only. In the area of mental health, the experimentation and training branch of NIH recently awarded a small contract to the University of Mississippi, a part of which is concerned with indexing mental health video tapes. A third effort in this direction is the contract recently awarded the Division of Nursing of the Public Health Service to a joint project group of the ANA and NLN to locate and index audio-visual materials in nursing.

A recurring problem in preparing surrogates to audio-visual materials is the preparation of descriptive summaries of the material. Since the index generally is prepared from these descriptions, it follows that indexing is also a major problem. One possible solution to this problem might be the inclusion of a visual clip of the film as a description instead of the written text. With the increasing use of microfiche throughout the country this might very well be a practical and more efficient solution to the problem in the future.

Once the existing audio-visual program has been identified by the user, the next problem is one of attempting to obtain a copy of this material from the producing institutions. The availability for exchange of these materials sometimes becomes a cumbersome problem involving the recovery of the cost of making copies, the clearance of faculty rights, copyright laws, etc. It is hoped that some order can, in the near future, be brought of the chaos regarding this matter, perhaps through greater cooperation between various regional medical programs and their production facilities. Once the copy of the audio-visual material, be it audio tape, film, or video tape, has been obtained, the next problem that the learner confronts is the need to obtain the piece of educational hardware that is compatible with the software package. Most of the difficulty in this area resides in the replaying of video tapes, although some difficulty has been experienced in the playback of certain film cartridges. One recommendation that must be made is that there be established some set of guidelines to advise the educational institutions and hospitals regarding the need fully to explore the format of the educational programs before the educational hardware is purchased.

Primary Users of Audio-Visual Materials in Health Science Education

The customer community of audio and audio-visual materials includes:

a. The practicing physician who is concerned with continuing education;

b. The practicing nurse, who wishes to continue education and training in new techniques and equipment;

c. The medical technologist or other allied health professional, who seeks initial training and continued education in the use of new procedures and equipment;

d. The student in the health sciences, who desires to extend his knowledge, review his deficiencies, pace himself in his learning, and himself;

e. The mental health caseworker, who is concerned with patient evaluation; and

f. The layman, who seeks aid in health counseling.

The audio-visual education package for the above individuals must vary with regard to the level of the presentation, whether its objective is the conveying of information and concepts, or the means by which these individuals can develop and/or improve medical skills. It is also obvious that the format for transmission of this material, as well as the time required to learn it, must vary from individual to individual. With the above requirements in mind, it is imperative that the media involved be as flexible as possible and that the use of the machinery involved for retrieval of this information be easily operated by all students of the health care team.

Following are typical applications of the use of audio-visual materials in health science education environments:

1. Augmented Instruction. This is one of the most popular applications for slides and films. Here the instructor uses the audio-visual aids to reinforce his teaching in the context of a lecture or seminar. Audio-visual materials

can be used separately and then followed by supplementary instruction.

2. Independent Learning. Here films, audio tapes, and video tapes are used in lieu of personal student-teacher contacts. This form of instruction is used most commonly in continuing medical education where the instructor is not available or the students cannot be scheduled for a group meeting. Topically self-standing films on selected medical topics and video tapes transmitted via various medical TV networks are typical of these types of materials. The audience, in this case, is the practicing physician, allied professional, or technologist.

3. Training in the Development of Techniques and Skills. Audio-visual materials for training purposes have long been popular with manufacturing firms. The audio-visual materials in this case are training aids used on production lines to guide wiremen and assemblers. This technique has also been used quite extensively in training hospital corpsmen of various military organizations and more recently in some areas of dental care.

4. Counseling. The availability of the Fairchild Mark IV 8mm cartridge film projector and other devices of this type have encouraged institutions to produce 8mm films for laymen audiences. One of the most popular series in use at the present time for this purpose is that produced by Professional Research Incorporated (PRI) for use as a film

subscription service to be used by medical practitioners for patient counseling in their offices.

5. Self-Assessment, Evaluation, and Role Playing. The introduction of video tape recording equipment which does not require elaborate production facilities is stimulating the use of television for the self-assessment of medical students. The University of Colorado School of Medicine medical students record their initial confrontations with a patient on video tape, including the taking of his history and physical. These tape recordings are played back for the purpose of self-analysis by the student or peer analysis with his classmates. Faculty review these on occasion to establish some degree of evaluation of the clinical performance of the student. Similar utilizations of this medium are directed toward the attempt to provide means of establishing attitudinal differences and attitudinal changes between various members of the health care team. This is a means of recording various role-playing episodes in which a wide variety of characters and events are simulated. The tapes produced by the above means have little value to a general audience and are usually erased after they have been reviewed.

6. Interview Records. Both audio and video tape recorders have been used to maintain an ongoing record of patient

performance during the passage of time in treatment. This makes it possible to review the course of a patient's illness and, in the case of a mental health patient, to evaluate the progress made during various stages of therapy administered to that patient.

In view of these possible ways of using educational software in different environments, it appears that one of the key members of the total health care delivery team should be an educational consultant. This individual should be aware of what educational material is available, in what format, and for which level of learner at any given point in time. The educational consultant would have the responsibility of writing the educational prescription for each learner. This individual might be the director of medical education of the hospital or group clinic, the supervisor of nursing education in the hospital or public health agency, the medical librarian of a medical group or society, or even the health practitioner himself in a remote area.

Description of Facilities, Equipment, and Capabilities Required for Extended Use of Audio and Audio-Visual Materials in Medical Schools and Community Hospitals

The facilities, equipment, and capabilities required for extended use of audio-visual materials in medical schools and community hospitals will vary depending upon a wide variety of factors (space, funding, etc.). The most important factor to consider, however, is not the sophistication of the hardware but the educational objectives

of the instructors and the motivational problems of the learners.

One key aspect regarding these facilities is in the area of operational administration. The leadership of any size educational facility must be aware of the innovations in education, dedicated to enhancing the educational process and able to enjoy the full support of the administrative arm of the school, hospital or clinic. The educational facility and its program must be assigned a top priority in the organization. Hardware may vary in quantity, levels of sophistication, and imagery but failure to receive the proper visibility and support can lead to failure of the educational program. One administrative arrangement that appears to be working is at the University of Colorado Medical Center and is described in Appendix A.

Mention was made earlier of the variability of equipment that can exist in schools and hospitals depending upon the level of support and the size of the student population.

If the facility under consideration is to be delegated as a regional production and distribution center, then the equipment required is similar to that available in commercial film and television studios. The unique requirement for color presentations that seem to be more essential for medical education than other forms of higher education must be considered at all stages of production, distribution and retrieval. An itemized list of such production equipment needs along with their cost could be arrived

at without much difficulty but is beyond the scope of this report.

The facilities and equipment required for the retrieval of the educational programs ("software") by the learners are much less costly. The emphases that are required for these stations are regarding their compatibility, convenience of retrieval and durability.

The need for <u>compatibility</u> of software packages and hardware capability between hospital stations within regions and between regions cannot be overemphasized. Only through careful planning regarding these factors can we assure a minimal amount of duplication of effort and a maximal utilization of the educational dollar. It is recommended that a national committee be formed to survey these problems of compatibility and make some recommendations regarding the feasibility of attempting some degree of standardization in this critical area.

The <u>convenience</u> of retrieval of the audio-visual program is another essential factor in the mechanics of multimedia education. Convenience in this instance refers not only to the comfort of the physical setting but temporal accessibility to this facility, the ease of operation of the hardware and most importantly, the availability of audio-visual programs that are relevant to the educational needs of the learner.

Another major factor to be considered in the provision of software and hardware packages for retrieval stations concerns

their reliability and durability. Most hospitals and libraries are understaffed and not able to provide the personnel required to adequately maintain audio-visual equipment. When the selection of the hardware and software packages is made, it is essential that they be as "user-proof" as possible in order to minimize the down-time of the equipment available for use by the individual learner. A mechanism for routine periodic service visits by members of the regional audio-visual technical staff must be built into the development of the distributional plans for this biomedical communications network.

The Role of the Biomedical Communications Center in the Handling and Sharing of these Materials

It is obvious that any communications center is effective only when it initially recognizes the heterogeneous needs and capabilities of its receivers. At the outset, it must be emphasized that the major role the Biomedical Communications Network could play is in the development of well-staffed, efficient regional centers for biomedical communication. These regional biomedical communications centers would be in a much better position to translate the educational needs of a given region into the production and distribution of educational programs for enhanced learning by the local health care practitioner and lay public. The major role that the centers would serve would be one of coordination and cataloging of available educational materials with major assistance in the production of

new yet "regionally flexible" software packages.

The first order of business is the problem of cataloging existing materials. Although several catalogs exist, there is no one completely up-to-date, authentic compilation available at this time. In order to prevent duplication of existing high-quality programs, this first step is essential. The retrieval format, at the outset, could be patterned after the MEDLARS System and, with a "crash program" employing the full facilities of the MEDLARS program for a brief period of time, this task could be accomplished in relatively short order. Refinement of the cataloging problems can be accomplished after the initial inventory has been made. To defer this cataloging until a near perfect format of indexing has been agreed upon (if ever) merely adds to the costly duplication and reduplication of programs that occur daily, out of ignorance, throughout the country.

Concurrently with the compliation of the audio-visual index, an in-depth survey should be undertaken of the total community of health science educators, testing services, certification boards, etc., to attempt to attain a priority listing of the key specific topical educational objectives of each of the various disciplines involved in the delivery of health care. A similar survey should be undertaken of all categories of health science student learners in an attempt to establish how they feel they learn best, <u>now</u>. (i.e., how they are helping the educators achieve their educational objectives). Only after an attempt has been made to collect the

above data will it be possible to begin the discussion of the development and distribution of the acceptable formats of educational software that will augment meaningful learning. Only after the existing supply of audio-visual materials has been inventoried and some idea of the immediate need for programs has been established, should the centers begin to support or contract for support of audio-visual productions. A priority must be established regarding these productions and the regional site for their production must be ascertained. In all instances, the productions that are made available for distribution by a region must be in such a format that they can be altered region by region with minimal problems and cost in order to enhance the meaning to the learners in the local region. Audio-visual materials must be topically and regionally relevant in order to help achieve maximal learning. It is extremely difficult to achieve such learning from a single center alone, mainly because the institutional, professional, and educational objectives vary extensively from region to region.

Once these problems have been alleviated, the highly developed hardware systems that enhance the reproduction and distribution of anything (including educational materials) can be counted on to carry out the job of handling and sharing the products obtained. We ask here that the audio-visuals and their messages be made sophisticated, thoughtful, and worth sharing.

APPENDIX A

UNIVERSITY OF COLORADO MEDICAL CENTER
4200 E. 9th Avenue
Denver, Colorado

The Office of Educational Resources in the Health Sciences

Consistent with the increasing developments and demands within the Medical Center the educational resources have been reorganized under one office, The Office of Educational Resources in the Health Sciences. This Office will be under the Vice President for Medical Affairs and its Director, Dr. William G. Cooper, will coordinate the Unit Teaching Laboratories, the Office of Audio-Visual Education in the Health Sciences, and the newly developed Office for Research in Health Science Education. The aim of each division of the Educational Resources Office will be to provide services to faculty members and departments throughout the Medical Center.

The Unit Teaching Laboratories for medical students will be occupied in September, 1968. Similar facilities for graduate students and students in medical technology and dentistry are being planned. It is hoped that a centralization of the management of these facilities can be achieved and thereby enhance the growth and utilization of present and future facilities for all students in the health sciences.

The Office of Audio-Visual Education in the Health Sciences will consist of the following subdivisions: a laboratory of medical photography, a film production laboratory, a graphic arts facility, a film and video tape library service unit, an office for radio and television programming, and a coordinated projection service unit to facilitate communications in lecture rooms and auditoria throughout the Medical Center complex. The operation of this activity will be under the supervision of a Director of the Office of Audio-Visual Education in the Health Sciences, with Dr. Cooper also serving in this capacity. It will operate on a self-supporting basis with fees charged for equipment usage and all services rendered by the members of this Office.

The newly developed Office of Research in Health Science Education will be under the direction of Dr. Ray E. Helfer. Consultation services to those desiring it will be available beginning July 1, 1968. The staff of this unit will be happy to provide consultation for any faculty member within the Medical Center who desires to reevaluate specific educational programs or to establish research projects in Health Science Education. Initial projects to be conducted by the Office of Research in Health Science Education will include the comparative study of the effectiveness of various methods of undergraduate and postgraduate education. Some of these projects will be done with the support and cooperation of the Colorado-Wyoming Regional Medical Program and the Office of Postgraduate Education.

The consolidation of these three areas of the learning process (laboratory, communications and educational research) under one office will assist in the administration, staffing and equipping of these facilities, and hopefully will afford a better atmosphere for learning for our students in the health science professions.

The following organizational chart should be helpful.

UNIVERSITY OF COLORADO MEDICAL CENTER
4200 E. 9th Avenue
Denver, Colorado

VICE PRESIDENT FOR MEDICAL AFFAIRS

OFFICE OF EDUCATIONAL RESOURCES
Dr. William G. Cooper, Director

UNIT TEACHING LABORATORIES

Dr. William G. Cooper, Director
Barbara Anderson, Secretary
Edward J. Egozcue, Lab Supervisor
Jennie Neff, Lab Technologist I
Benny Letcher, Lab Technologist I
Elwood Abbott, Lab Technologist I

OFFICE OF AUDIO-VISUAL EDUCATION IN THE HEALTH SCIENCES

Dr. William G. Cooper, Dir.
Barbara Anderson, Secretary
Lou Anne Costello, Secretary

OFFICE OF RESEARCH IN HEALTH SCIENCE EDUCATION

Dr. Ray E. Helfer, Director
Kay Shipley, Secretary

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K. Stauffer

RADIO AND TV PROGRAMMING

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N. Fringer
J. Nidiffer
D. Wiens
F. Lyons

FILM PRODUCTION LAB

F. Castro

PROJECTION SERVICE UNIT

D. Daddow
B. Milnes

FILE & VIDEO-TAPE LIBRARY

GRAPHIC ARTS FACILITY